Polymer Delivery Systems of Porphyrin Photosensitizers Monitored by NMR Spectroscopy

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Polymer nanoparticles are known delivery systems for porphyrin photosensitizers in photodynamic therapy (PDT). Photolon®, which is a polyvinylpyrrolidone (PVP) complex with chlorin e6 (Ce6), has already gained approval for medical application in PDT. Polymer carrier nanoparticles improve porphyrin monomerization, solubility and stability under physiological conditions, overcoming the consequences of their intrinsic tendency for aggregation thereby increasing the efficiency of PDT.

Previously we have shown that amino acid derivatives of chlorin e6 (xCE) are encapsulated into polyvinylpyrrolidone [1] and Kolliphor P188 (KP) [2] by using NMR spectroscopy techniques. We have also studied their aggregate structures, and monitored their interactions with membrane models [3].

In this study, various 1D and 2D NMR techniques were recorded to characterize the polymer-porphyrin ensemble, with a focus on the structural characterization, disaggregation capabilityand loading capacity of the polymers. The NMR data reveal that PVP binds stronger to amino acid derivatives of chlorin e6 compared to KP (stable complex vs equilibrium). In addition, the cellular uptake of serine-chlorin e6 has been followed by fluorescence detection after cell incubation with serine-chlorin e6 encapsulated either into PVP or into a KP polymer matrix.

Further studies are currently in progress to compare the effect of PVP and Kolliphor P188 as delivery system for SerCE on the metabolic response of HeLa cells.

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